From Content-Based Music Emotion Recognition to Emotion Maps of Musical Pieces

Music has a profound impact on our emotions. It can make us feel happy, sad, angry, or relaxed. It can even evoke memories and nostalgia. But how can we measure and analyze the emotional content of music? This is the question that content-based music emotion recognition (MER) seeks to answer.

MER is a subfield of music information retrieval (MIR) that deals with the automatic recognition of emotions from musical audio signals. It is a challenging task, as music is a complex and multifaceted art form. However, MER has made significant progress in recent years, thanks to advances in signal processing, machine learning, and artificial intelligence.

In this article, we will provide a comprehensive guide to the field of content-based MER. We will cover the latest research, techniques, and applications. We will also introduce the concept of emotion maps of musical pieces, which offer a visual representation of the emotional content of music.

From Content-based Music Emotion Recognition to Emotion Maps of Musical Pieces (Studies in Computational Intelligence Book 747)

★★★★★ 5 out of 5

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Enhanced typesetting	: Enabled
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Content-based MER refers to the recognition of emotions from musical audio signals without relying on any external information, such as lyrics or genre labels. This is in contrast to knowledge-based MER, which uses external knowledge to infer emotions from music.

Content-based MER is based on the assumption that the emotional content of music is reflected in its acoustic features. These features can be extracted from the audio signal using a variety of signal processing techniques. The most common features used for MER include:

- **Spectral features:** These features describe the frequency content of the audio signal. They can be used to capture the overall brightness, darkness, and timbre of the music.
- **Temporal features:** These features describe the temporal structure of the audio signal. They can be used to capture the rhythm, tempo, and dynamics of the music.
- **Timbral features:** These features describe the perceptual qualities of the audio signal. They can be used to capture the roughness, brightness, and warmth of the music.

Once the acoustic features have been extracted, they can be used to train a machine learning model to recognize emotions. The most common machine learning algorithms used for MER include:

- **Support vector machines:** Support vector machines are a type of supervised learning algorithm that can be used to classify data into different categories. They are often used for MER because they are able to handle high-dimensional data and can generalize well to new data.
- **Random forests:** Random forests are a type of ensemble learning algorithm that can be used to classify data into different categories. They are often used for MER because they are able to handle noisy data and can produce accurate predictions.
- **Neural networks:** Neural networks are a type of deep learning algorithm that can be used to classify data into different categories. They are often used for MER because they are able to learn complex patterns in the data.

Content-based MER has a wide range of applications, including:

- **Music recommendation:** MER can be used to recommend music to users based on their emotional state. For example, a user who is feeling sad might be recommended music that is calming and relaxing.
- **Music therapy:** MER can be used to develop music therapy interventions for patients with mental health conditions. For example, music that is upbeat and positive might be used to help patients with depression.
- **Music search:** MER can be used to search for music based on emotional criteria. For example, a user might search for music that is "happy" or "relaxing".

- **Music analysis:** MER can be used to analyze the emotional content of music. This information can be used by music scholars to better understand the emotional impact of music.

Emotion maps are a visual representation of the emotional content of music. They are created by plotting the emotional content of music over time. This can be done using a variety of methods, such as:

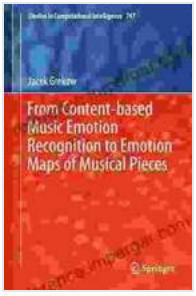
- **Subjective ratings:** Listeners can be asked to rate the emotional content of music at regular intervals. The resulting ratings can be plotted over time to create an emotion map.
- **Physiological measures:** Physiological measures, such as heart rate and skin conductance, can be used to measure the emotional response to music. The resulting data can be plotted over time to create an emotion map.
- **Machine learning:** Machine learning algorithms can be used to classify the emotional content of music. The resulting classifications can be plotted over time to create an emotion map.

Emotion maps can be used to analyze the emotional structure of music. For example, they can be used to identify the emotional climax of a piece of music or to track the emotional changes that occur over time. Emotion maps can also be used to compare the emotional content of different pieces of music.

Content-based MER is a powerful tool for analyzing and understanding the emotional content of music. It has a wide range of applications, including music recommendation, music therapy, music search, and music analysis. Emotion maps are a visual representation of the emotional content of

music. They can be used to analyze the emotional structure of music and to compare the emotional content of different pieces of music.

As the field of content-based MER continues to develop, we can expect to see even more innovative and groundbreaking applications of this technology.



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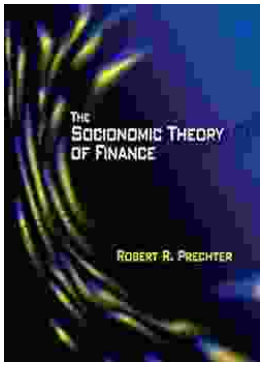

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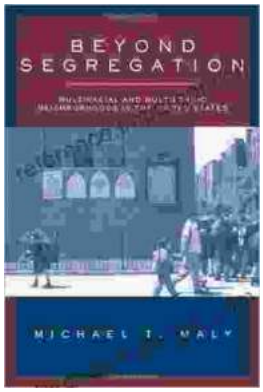

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